1.0 Introduction

On June 21, 1999, USEPA issued a Unilateral Administrative Order (UAO) requiring replacement of all culverts in Dead Creek to eliminate an alleged imminent threat to public health and the environment resulting from flooding. Solutia responded on July 15 and 30, 1999 indicating that culvert replacement would not solve the problem of flooding and proposed, as an alternative, a time critical removal action consisting of: 1) replacing culverts at Cargill Road and the Terminal Railroad Association (TRRA) embankment, 2) clearing vegetation in the Dead Creek channel between Route 3 and Cargill Road, 3) pumping storm water from Creek Segment B to the American Bottoms POTW and 4) moving sediments from Creek Sector B to an on-site, double-lined containment cell. USEPA responded to this offer on September 24, 1999 indicating that culvert replacement and storm water pumping could proceed but movement of sediments to an on-site cell was outside the scope of the order.

Solutia voluntarily initiated an evaluation of culvert replacement in May 1999. This evaluation, completed in July 1999, indicated that replacing culverts at Cargill Road and the TRRA embankment would lower water levels at these locations by approximately 1.5 feet. As originally envisioned, the 48-inch culvert at Cargill Road would be replaced by a single 60-inch culvert and the 36-inch pipe at the TRRA embankment would be replaced by a V-notch cut. Engineering evaluation indicated that three 48-inch CMP culverts were needed at Cargill Road and that a V-notch cut could not be constructed at the TRRA embankment because two petroleum pipelines and one gas pipeline were embedded in it. Discussions with the pipeline owners indicated that a V-notch cut in the embankment would threaten the stability of the pipelines. As a result, a culvert alternative was selected for the embankment consisting of four 66-inch CMP culverts and one 54-inch CMP culvert.

Work on installing these culverts is proceeding with access agreement negotiations initiated with St. Clair County, the Terminal Railroad Association and several other landowners in October 1999. The Agency was briefed on project status on Friday, October 29, 1999 and given a preliminary scheduled for the culvert replacement removal action. To date, the TRRA has not granted access to install the embankment culverts and Solutia has requested USEPA to issue an order to TRRA if a last effort at obtaining access is unsuccessful.

Initial discussions of the feasibility of pumping storm water to American Bottoms was discussed with the POTW on September 28, 1999 and several issues were identified that needed resolution before pumping could occur: 1) identification of the constituents present in the storm water and determination of their concentrations, 2) determination if any of these compounds could not be treated by the American Bottoms system, 3) whether or not PCB concentrations would be above a regulatory limit of 3 parts per billion and 4) the impact of this discharge on sludge quality and the ability to dispose of this material in a municipal landfill. Work on these issues is in progress. However, Solutia does not propose to implement a storm water pumping system independent a sediment removal action. The culvert at the downstream end of Creek Segment B was blocked in 1965 although the Village of Sauget has installed a high-level overflow to prevent flooding of Judith Lane and a nearby residential area. Pumping was considered a stop gap measure to prevent downstream migration of impacted sediments during storm conditions prior to and during the sediment removal action. Since storm flows can exceed 52.2 cubic feet per second (23,400 gallons per minute), long term pumping and treatment of this discharge is impracticable.

Solutia met with the Agency on October 19, 1999 to discuss construction of a double-lined, on-site containment cell built to RCRA minimum technology standards to contain sediments removed from Creek Segment B. Representatives from both Superfund and TSCA were present at the meeting. Based on this meeting it appeared that Solutia could meet the substantive requirements for a TSCA cell and made a commitment to submit a containment cell design to the Agency on December 3, 1999. URS Greiner Woodward Clyde was authorized to prepare a RCRA minimum technology design that would meet TSCA requirements on October 28, 1999 and this design was submitted to the Agency on December 3, 1999. In addition, URS was authorized to undertake a foundation evaluation of the proposed location of the containment cell. Current plans call for constructing this cell immediately adjacent to the west bank of Dead Creek just south of Site G on property owned by Solutia.

During the October 19, 1999 meeting, the Agency requested that Solutia prepare an evaluation of three alternatives for handling sediment removed from Creek Segment B. Solutia committed to prepare an alternatives evaluation and submit it to the Agency on November 8, 1999. A "Removal Action Alternatives Evaluation, Sauget Area 1 Creek Segment B" was submitted to the Agency on November 8, 1999.

This document responds to the Agency's October 19, 1999 request for an evaluation of three alternatives for handling sediment removed from Creek Segment B and to comments made by the Agency during a meeting on January 5, 2000. Alternatives evaluated include: 1) removal and off-site treatment at an incinerator in St. Ambroise, Quebec, 2) removal and off-site disposal at a RCRA/TSCA landfill in Detroit, Michigan, 3) removal and off-site disposal at the SafetyKleen Lone Mountain, Oklahoma facility and 4) removal and on-site containment. The off-site disposal facilities were identified by the USEPA as potential sites for receiving excavated sediments.

2.0 Site Background

Dead Creek, an intermittent stream which is slightly more than three miles long, runs from Queeny Avenue in Sauget, Illinois downstream to Old Prairie Dupont Creek in Cahokia, Illinois. IEPA divided the creek in six segments during past investigations: Creek Segments A, B, C, D, E and F (Figure 1). Six source areas exist in the headwaters of Dead Creek: Site G, Site H, Site I, Site L, Site M and Site N. Wastes in these source areas, which have an estimated total area of more than 30 acres, came from a wide variety of municipal and industrial sources between the 1930s and 1980s. Current Agency estimates indicate that these sites have a total volume in excess of 400,000 cubic yards. Waste disposal has been a common land use throughout the history of the upstream portions of the site.

Sites G, H, L and M are located in Creek Segment B.

2.1 Creek Segment B

CS-B, which is now the upstream portion of Dead Creek, extends for approximately 2000 ft. from Queeny Avenue to Judith Lane. In 1965 the culvert at Judith Lane, the downstream end of CS-B, was blocked to prevent downstream flow of water. Sites G, H and L, which are described below, border this creek segment. Land use surrounding CS-B is primarily commercial and agricultural. Commercial land use occurs along Route 3 (Mississippi Avenue), Queeny Road and Falling Springs Road. Undeveloped land is used for agriculture with soy beans and winter wheat being the primary crops. A small residential area of approximately 20 homes is located on Walnut Street and Judith Lane in the southeastern corner of this creek segment.

Based on information contained in the AOC, maximum detected constituent concentrations in CS-B sediments are:

VOCs (parts per million)	
Benzene	0.1
Chlorobenzene	5.2
Ethylbenzene	3.6
Toluene	0.8
Xylenes	540

SVOCs (parts per million)	
Dichlorobenzene	12,000
Chloronitrobenzene	240
1,2-Dichlorobenzene	17
1,4-Dichlorobenzene	220
Fluoranthene	11
Phenanthrene	15
Pyrene	13
Trichlorobenzene	3,700

Pesticides/PCBs (parts per million)	
PCBs	10,000

Metals (parts per million)	
Arsenic	6,000
Cadmium	400
Copper	44,800
Lead	24,000
Mercury	30
Nickel	3,500
Silver	100
Zinc	71,000

2.2 Site G

Site G, located south of Queeny Avenue between Route 3 and Dead Creek, operated as a landfill from approximately 1952 to 1966. It covers an area of approximately five acres and contains an estimated 60,000 cubic yards of waste including oil pits, drums containing wastes, paper wastes, documents and lab equipment. Intermittent disposal continued through 1988 when the site was fenced pursuant to a USEPA removal action funded by PRPs including Solutia. USEPA conducted a second removal action in 1995, excavating soils containing PCBs, organics, metals and dioxin, solidifying open oil pits and placing a clean soil cap approximately 18 to 24 inches thick. Currently, Site G is a stable, vegetated and secured area that is not being used. Surface water drains radially away from the site as a result of the installation of the clean soil cap.

Based on information contained in the AOC, maximum detected constituent concentrations in Site G soils are:

VOCs (parts per million)	
Benzene	45
Chlorobenzene	538
Chloroform	12
Tetrachloroethene	59
Xylenes	42

Pesticides/PCBs (parts per million)	
4,4-DDE	135
Aroclor 1248	174
Aroclor 1260	5,300

Dioxin (parts per million)	
Dioxin	45

SVOCs (parts per million)	
Napthalene	5,429
Pentachlorophenol	4,769
Phenol	178
2,4,6-Trichlorophenol	49

Metals (parts per million)	
Arsenic	123
Barium	45,949
Copper	2,215
Lead	3,123
Mercury	34
Nickel	399
Zinc	4,257

PCB and dioxin concentrations in waste material are 3,000 and 51 parts per million, respectively.

2.3 Site H

Site H is located south of Queeny Avenue, west of Falling Springs Road and east of the Metro Construction Company property in the Village of Sauget. It is essentially a grassy field across the street from Sauget Village Hall that occupies approximately five to seven acres of land. Recent inspection indicates the site is stable with a vegetative cover and no wastes exposed at the surface. Cinders are present at the surface in some areas of the site. Commercial buildings and a self-storage facility are located on the site. A residential area of approximately 50 homes is located adjacent to the northeast corner of the site. Drainage is typically west toward CS-B, however, several small depressions capable of retaining rainwater are scattered across the site.

Chemical wastes were disposed at Site H from approximately 1931 to 1957. Wastes included drums of solvents, PCBs, paranitroaniline, chlorine, phosphorous pentasulfide and hydrofluosilic acid. Municipal wastes were also reportedly disposed at Site H. Waste volume is estimated to be 110,000 cubic yards. Based on information contained in the AOC, maximum detected constituent concentrations in Site H soils are:

VOCs (parts per million)	
Benzene	61
Chlorobenzene	452
Ethylbenzene	13
Tetrachloroethene	6
Toluene	76
Xylenes	24

SVOCs (parts per million)	
1,2-Dichlorobenzene	19,355
1,4-Dichlorobenzene	30,645
Fluoranthene	1,330
4-Nitroaniline	1,834
Phenanthrene	2,114
1,2,4-Trichlorobenzene	7,581

Pesticides/PCBs (parts per million)	
4,4-DDD	<1
4,4-DDE	<1
4,4-DDT	<1
Aroclor 1260	18,000

Metals (parts per million)	
Arsenic	388
Cadmium	294
Copper	2,444
Lead	4,500
Mercury	4
Nickel	15,097
Silver	44
Zinc	39,516

2.4 Site L

Site L, located on the east bank of Dead Creek immediately south of the Metro Construction Company property on Queeny Avenue, is comprised of two backfilled surface impoundments used by Wagner Trucking between 1971 and 1981 for disposal of wash water from truck cleaning operations. Currently, Site L, a cinder covered area of approximately 7,600 square feet, appears stable. Land use to the south and east is agricultural. Runoff from the site flows to CS-B. Based on information contained in the AOC, maximum detected constituent concentrations in Site L soils are:

VOCs (parts per million)		SVOCs (parts per million)	
Benzene	4	2-Chlorophenol	2
Chloroform	20	Di-n-butyl Phthalate	3
Toluene	27	Pentachlorophenol	58

Pesticides/PCBs (parts per million)		Metals (parts per million)	
PCBs	500	Antimony	32
		Arsenic	172
		Nickel	2,392

2.5 Site M

Site M, located at the end of Walnut Street, is surface impoundment with a surface area of approximately 59,200 square feet, a maximum depth of 14 feet and a sediment volume of approximately 3,600 cubic yards. Used as a sand borrow pit in the mid to late 1940s it is now hydraulically connected to Dead Creek through an eight-foot wide opening it its southwestern corner. Its banks are well vegetated and there is no evidence of current erosion and/or transport of sediments to Dead Creek. For these reasons, the site is considered stable.

Based on information contained in the AOC, maximum detected constituent concentrations in Site M sediments are:

VOCs (parts per million)	
2-Butanone	14

SVOCs (parts per million)	
Benzo(b)fluoranthene	15
Chrysene	12
1,2-Dichlorobenzene	26
1,4-Dichlorobenzene	40
Fluoranthene	21
Pyrene	27
1,2,4-Trichlorobenzene	14

Pesticides/PCBs (parts per million)	
PCBs	1,100

Metals/Inorganics (parts per million)	
Antimony	41
Arsenic	94
Barium	9,060
Cadmium	47
Copper	21,000
Lead	1,910
Nickel	2,490
Silver	26
Zinc	31,600
Cyanide	1

3.0 Creek Sector B and Site M Conditions

3.1 Sediment Chemistry

In 1998 Ecology and Environment, at the request of the Agency, compiled all existing analytical data for Dead Creek (Volume 1, Sauget Area 1 Data Tables/Maps, February 1998). Maximum detected sediment and soil concentrations are given below:

VOCs (parts per million)	
Acetone	5
Benzene	<1
2-Butanone	14
Carbon Disulfide	<1
Chlorobenzene	13
Ethylbenzene	4
4-Methyl-2-Pentanone	<1
Tetrachloroethane	<1
Toluene	5
Xylene	<1

SVOCs (parts per million)	
Acenapthene	3
Acenaphthylene	<1
Alkylbenzene	<1
Anthracene	4
Benzo(a)anthracene	9
Benzo(b)fluoranthene	30
Benzo(k)fluoranthene	15
Benzo(g,h,l)perylene	13
Benzo(a)pyrene	10
Bis(2-ethylhexyl)phthalate	18
Butylbenzylphthalate	2

PCBs (parts per million)	
PCBs	17,000

Metals/Inorganics (parts per million)	
Antimony	45
Arsenic	306
Barium	17,300
Beryllium	3
Boron	76
Cadmium	400
Chromium	400
Cobalt	100
Copper	44,800
Lead	24,000
Mercury	30
Nickel	3,500

Metals/Inorganics (parts per million)	
Selenium	602
Silver	100
Strontium	430
Thallium	4
Tin	32
Vanadium	100
Zinc	71,000
Cyanide	4

SVOCs (parts per million)	
Chrysene	12
Chloronitrobenzene	240
2-Chlorophenol	<1
Dibenzo(a,h)anthracene	4
Dibenzofuran	2
1,2-Dichlorobenzene	12,000
1,3-Dichlorobenzene	4
1,4-Dichlorobenzene	220
2,4-Dichlorophenol	<1
Di-n-butyl phthalate	<1
Di-ni-octyl phthalate	3
2,4-Dimethylphenol	<1
Fluoranthene	21
Fluorene	6
Hexachlorobenzene	2
Indeno(1,2,3-cd)pyrene	9
Isophorone	<1
2-Methylnapthalene	8
4-Methylphenol	<1
Napthalene	10
4-Nitrophenol	3
Pentachlorophenol	2
Phenanthrene	15
Pyrene	27
1,2,4-Trichlorobenzene	3,700
1,2,4-Trichlorophenol	5
2,4,5-Trichlorophenol	<1
2,4,6-Trichlorophenol	<1

80% (8 of 10) of the VOC maximum concentrations in CS-B sediment and soil are between <1 and 10 ppm and two (20%) are between 10 and 20 ppm. SVOC maximum concentrations are grouped as follows: 26 of 39 (67%) between <1 and 10 ppm, 6 of 39 (15%) between 11 and 20 ppm, 3 of 39 (8%) between 21 and 50 ppm and 4 of 39 (10%) greater than 100 ppm. Metals maximum concentration distributions are 5 of 20 (25%) between 1 and 50 ppm, 5 of 20 (25%) between 51 and 100 ppm, 5 of 20 (25%) between 101 and 1,000 ppm and 5 of 20 (25%) greater than 1000 ppm.

Using organic concentrations of greater than 100 ppm and metals concentrations of greater than 1,000 ppm to focus on constituents with the highest detected concentrations, the following summary statistics result:

	Maximum Concentration	95th Confidence Interval	Arithmetic Mean	Geometric Mean	Minimum Concentration
Organics (ppm)					
PCBs	17,000	5,200	9,706	108	<1
1,2-Dichlorobenzene	12,000	9,675	1,367	10	<1
1,2,4-Trichlorobenzene	3,700	1,679	342	11	<1
Chloronitrobenzene	240	236	203	201	170
Inorganics (ppm)					
Zinc	71,000	53,350	14,126	5,047	30
Copper	44,800	36,050	11,186	2,890	27
Lead	24,000	2,795	1,313	319	6
Inorganics (ppm)					
Barium	17,300	8,578	2,400	1,089	41
Nickel	3,500	3,000	937	367	12

3.2 Sediment Volume

Creek Segment B - Solutia evaluated removal of sediment from Creek Segment B in 1991/1992. As part of this evaluation, sediment volume was estimated by assuming an average channel bottom width and sediment depth of 20 ft and 2 ft, respectively. For a stream length of 1600 ft., the estimated sediment volume was 4,000 to 4,500 tons. This translates to 2,700 to 3,000 cubic yards using a conversion factor of 1.5 tons per cubic yard.

Recalculating to verify this estimate yields a sediment weight of 3,555 tons:

$$\begin{aligned}\text{Volume} &= 1600\text{ ft }(20\text{ ft})(2\text{ ft})\\ &= 64{,}000\text{ ft}^3\\ &= 2{,}370\text{ yd}^3\end{aligned}$$

$$\begin{aligned}\text{Weight} &= 2{,}370\text{ yd}^3\ (1.5\text{ tons/ yd}^3)\\ &= 3{,}555\text{ tons}\end{aligned}$$

The difference between this calculated amount and the 4,000 to 4,500 volume estimate included in the 1991/1992 Solutia estimate is probably due to rounding up of the volume to account for uncertainties in the assumptions of channel width and depth. It could also be due to inclusion of the northern 400 ft of CS-B in the volume estimate in order to estimate project costs if access to the this portion of the creek was granted by the property owners.

The northern 400 ft. of CS-B was not included in the Solutia estimate because access could not be obtained for this portion of the drainage channel. Estimated volume and weight for this stretch using the 1991/1992 estimate assumptions are:

$$\begin{aligned} \text{Volume} &= 400 \text{ ft } (20 \text{ ft})(2 \text{ ft}) \\ &= 16{,}000 \text{ ft}^3 \\ &= 593 \text{ yd}^3 \end{aligned}$$

$$\begin{aligned} \text{Weight} &= 593 \text{ yd}^3 \ (1.5 \text{ tons/ yd}^3) \\ &= 890 \text{ tons} \end{aligned}$$

With the 1991/1992 estimating methodology, the total estimated volume of sediment in CS-B is 2,963 yd^3 and the total estimated weight is 4,445 tons.

Site M - In 1991/1992 Solutia also estimated the volume of sediment in Site M to be 3,800 yd^3 with a weight of 5,000 tons. To verify this estimate, an average sediment thickness of 1.6 feet was calculated from Site M sediment thickness measurements included in the 1991 Geraghty and Miller report "Site Investigation for Dead Creek Sector B and Sites L and M, March 1992". With this average sediment thickness, the estimated sediment volume in Site M is:

$$\begin{aligned} \text{Volume} &= 59{,}200 \text{ ft}^2 \ (1.6 \text{ ft}) \\ &= 94{,}720 \text{ ft}^3 \\ &= 3{,}508 \text{ yd}^3 \end{aligned}$$

$$\begin{aligned} \text{Weight} &= 3{,}508 \text{ yd}^3 \ (1.5 \text{ tons/ yd}^3) \\ &= 5{,}262 \text{ tons} \end{aligned}$$

This analysis verifies the original sediment volume and weight estimates for Site M.

Creek Segment B and Site M Volume Estimate - Based on work done by Solutia in 1991/1992 the total estimated volume of sediment in CS-B and Site M is 6,493 yd^3 with a total estimated weight of 9,445 tons. For planning purposes, the estimated volume of sediments in CS-B and Site M is 10,000 cubic yards with a weight of 15,000 tons.

4.0 Alternatives Evaluation

Solutia agrees with the Agency that removing sediments from Creek Segment B is the best and fastest approach to eliminate the potential for human exposure to the impacted sediments. Sediments in this segment of the creek have concentrations of PCBs, copper, lead and zinc that should be prevented from moving downstream:

Constituent	Maximum Concentration (ppm)	Average Concentration (ppm)
PCB	17,000	9,706
Copper	44,800	36,050
Lead	24,000	1,313
Zinc	71,000	14,126

Plugging the culvert at Judith Lane, the downstream end of CS-B, in 1965 limited the downstream movement of constituents. Installation of a high-level overflow by the Village of Cahokia could result in downstream migration of constituents during storm conditions as could storm flows large enough to cause overtopping of Judith Lane. Therefore, sediment removal is a positive action that will protect public health and the environment and demonstrate progress toward a Dead Creek remedy after a long period of study and evaluation. Since an EE/CA process is already underway for soil, surface water, sediments and air, a time-critical removal action with a maximum planning process of six months duration is the best procedural vehicle for moving forward.

As mentioned in the Introduction, the Agency asked Solutia to evaluate four removal alternatives: 1) removal and off-site incineration, 2) removal and off-site disposal at the EQ facility in Michigan, 3) removal and off-site disposal at the SafetyKleen facility in Oklahoma and 4) removal and on-site containment. These four alternatives are evaluated below.

4.1 Off-Site Incineration

Removal and off-site incineration of CS-B sediments would provide a permanent solution, however, there are a number of issues that need to be resolved before off-site incineration could be implemented as a remedy.

USEPA identified an incineration contractor with a facility in St. Ambroise, Quebec willing to accept the CS-B sediments and who claimed to be able to transport and incinerate PCB containing wastes for $250 to $300 per ton. There is a significant regulatory barrier to using a Canadian incinerator to treat PCB-containing sediments, namely the export of PCBs. Export of PCB-containing wastes is banned under TSCA unless USEPA grants a waiver for their export. In the December 6, 1995 preamble to the proposed PCB rule, USEPA stated that "EPA believes that export of PCBs to other countries needs to be limited so as not to pose the risk of injury to the health or the environment in those countries and that to the maximum extent practicable, each nation should manage its own waste within it own borders" (59 CFR 62,817). In addition, Canada has it own PCB import restrictions. A conversation with USEPA Washington indicates that it could take two to three years to obtain the waiver needed to export PCBs. This will not fit within the six month planning time frame of a time-critical removal action.

If the regulatory issues could be addressed in a timely manner, the known presence of volatile metals, such as lead and zinc, and the suspected presence of dioxins may make it technically infeasible to incinerate CS-B sediments. Lead occurs in CS-B sediments with a maximum concentration of 24,000 ppm and an average concentration of 1,313 ppm. Air emission control systems on incinerators are not typically designed to handle lead concentrations of this magnitude. With a maximum concentration of 71,000 ppm and an average concentration of 14,126 ppm, zinc may also overload an incinerator's air emission control system.

Dioxin was detected in Site G soils at a maximum concentration of 45 ppm and in waste material at a maximum concentration of 51 ppm. Given the proximity of Site G to Creek Segment B it is reasonable to assume that dioxin will be present in the sediments. Most incinerators have permit restrictions that preclude treating dioxins. Only one facility in the US (Coffeyville, Kansas) is permitted to burn them. This facility burns dioxin on a campaign basis and has quoted a $2.00 per pound treatment cost to USEPA.

Another issue associated with off-site incineration is cost. Bennett Environmental is claiming an all-in transportation and incineration cost of $250 to $300 per ton. If this is the actual cost range, then transportation and off-site incineration of 15,000 tons of impacted sediments would cost $3,750,000 to 4,500,000. Experience indicates this cost is unrealistically low. Bennett states that low costs can be achieved by using barge or rail shipment. While shipping by barge or rail can lower shipping costs such shipping methods typically can not be for wastes or contaminated environmental media because loading and unloading facilities do not exist at the either the shipping and/or receiving points. The time needed to permit a rail or barge loading facility in Sauget will not fit within the six month planning time frame of a time-critical removal action. In addition, there is no rail spur leading to CS-B. Impacted sediments would need to be excavated and trucked to the rail or barge loading facility. This double handling will increase removal and transportation costs.

Trucking is the only practical method for transporting sediments to St. Ambroise, Quebec, a distance of approximately 1350 miles. Typical costs for truck transportation range from $2.50 to $3.00 per mile. Transporting 15,000 tons of CS-B sediments would require 750 trips with 20 ton truck loads. Total transportation costs would range from $2,500,000 to $3,000,000.

Current rates for incineration of soil or sediments are $500 to $860 per ton. A $500 per ton rate applies to RCRA bulk solids; the $860 per ton rate applies to RCRA bulk solids containing either metals or PCBs. Both of these rates are current market prices based on competitive bidding. At these rates, incineration of 15,000 tons of CS-B sediment would cost $7,500,000 to $12,900,000. Total cost for transportation and incineration would be $10,000,000 to $15,900,000. Material handling costs of $35 to $70 per ton ($50 to $100 cubic yard) to excavate, dewater, solidify and load CS-B sediments would add $500,000 to $1,000,000 to project costs.

Costs for an off-site incineration removal action will be in the range of $10,500,000 to $16,900,000 not including costs for engineering, project management, agency oversight, water treatment, etc.

4.2 Off-Site Disposal

Removal and off-site disposal of CS-B sediments would protect public health and the environment by containing the impacted sediments in a secure disposal facility. RCRA Land Disposal Restrictions will determine whether or not CS-B sediments can be land disposed without treatment. For organic constituents, treatment is presumed to be incineration although thermal desorption and solvent extraction can also be used to achieve the Universal Treatment Standards. One of ten VOCs detected in CS-B sediments exceeded its UTS and 15 out of 39 detected SVOCs exceeded their UTS's:

Regulated Constituent	Universal Treatment Standard (mg/kg)	Maximum Concentration (mg/kg)	Average Concentration (mg/kg)
VOCs			
Chlorobenzene	6.0	13.0	2.7
SVOCs			
Anthracene	3.4	3.9	1.8
Benzo(a)anthracene	3.4	9.4	3.4
Benzo(b)fluoranthene	6.8	30.0	5.6
Benzo(k)fluoranthene	6.8	15.0	3.5
Benzo(a)pyrene	3.4	10.0	3.1
Chrysene	3.4	12.0	4.2
1,2-Dichlorobenzene	6.0	12,000.0	1,367
1,4-Dichlorobenzene	6.0	220.0	21.2
Fluoranthene	3.4	21.0	7.1
Fluorene	3.4	5.9	2.3
Indeno(1,2,3-cd)pyrene	3.4	9.0	2.2
Napthalene	5.6	9.5	2.9

Regulated Constituent	Universal Treatment Standard (mg/kg)	Maximum Concentration (mg/kg)	Average Concentration (mg/kg)
SVOCs			
Phenanthrene	5.6	15.0	4.5
Pyrene	8.2	27.0	9.2
1,2,4-Trichlorobenzene	19	3,700.0	342.6

Both maximum and average concentrations of six SVOCs exceed their Universal Treatment Sandards: 1) Chrysene, 2) 1,2-Diclorobenzene, 3) 1,4-Dichlorobenzene, 4) Fluoranthene, 5) Pyrene and 6) 1,2,4-Trichlorobenzene. While it may be possible to land dispose constituents whose maximum concentrations exceed their UTS, it is not possible to land dispose constituents whose average concentration exceeds their UTS unless their concentrations are reduced to less than the UTS by treatment. Since thermal treatment or solvent extraction would be required prior to land disposal of CS-B sediments, it is not possible to complete the planning process within a six month time frame. Therefore, a time-critical removal action could not include off-site disposal. In addition, the EE/CA that is currently being performed as part of the AOC for Sauget Area I is evaluating thermal treatment of wastes and sediments.

RCRA also limits land disposal of leachable metals and they are prevalent in CS-B sediments. TCLP data is available for four sediment samples from CS-B and two sediment samples from Site M:

Regulated Constituent	Universal Treatment Standard - TCLP (mg/l)	TCLP Concentration (mg/l)
Antimony	1.15	
Arsenic	5.0	< 0.20
Barium	21	3.7
Beryllium	1.22	
Cadmium	0.11	0.51
Chromium	0.60	< 0.50
Lead	0.75	0.52
Mercury	0.025	< 0.020

Regulated Constituent	**Universal Treatment Standard - TCLP (mg/l)**	**TCLP Concentration (mg/l)**
Nickel	11	
Selenium	5.7	< 0.50
Silver	0.14	< 0.010
Thallium	0.20	
Vanadium	1.6	
Zinc	4.3	

The Universal Treatment Standard for cadmium is exceeded and treatment is required before land disposal. Treatment will increase the duration and cost of the CS-B removal action.

RCRA also requires treatment of soil with regulated constituent concentrations greater than ten times the UTS. Soil must be treated so that the concentration of the regulated constituent is reduced by 90% or to a concentration ten times the UTS.

Regulated Constituent	**Universal Treatment Standard - 10X (mg/l)**	**Maximum Concentration (mg/kg)**	**Average Concentration (mg/kg)**
Antimony	11.5	**45**	**33**
Arsenic	50.0	**306**	45
Barium	210.0	**17,300**	**2,400**
Beryllium	12.2	3	2
Cadmium	1.1	**400**	**54**
Chromium	6.0	**400**	**96**
Lead	7.5	**24,000**	**1,313**
Mercury	0.25	**30**	**2**
Nickel	110.0	**3,500**	**937**
Silver	1.4	**100**	**25**
Thallium	2.0	**4**	**4**

Maximum and average concentrations of antimony, barium, cadmium, chromium, lead, mercury, nickel, silver and thallium all are greater than ten times the Universal Treatment Standard. The maximum concentration of arsenic is also greater than ten times the UTS. Therefore, treatment is required before CS-B sediments can be land disposed off site. Treatment will increase the duration and cost of the CS-B removal action. With average barium, lead and nickel concentrations of 2,400, 1,313 and 937 ppm, respectively, it may be difficult to achieve the required 90% reduction in concentration to 240, 131 and 94 ppm, respectively.

Since CS-B sediments contain PCBs with concentrations greater than 50 ppm, any off-site disposal facility selected to receive excavated sediments would need a TSCA permit. As demonstrated above, a number of constituents present in CS-B sediments exceed RCRA Universal Treatment Standards. Therefore, organic-containing sediments need to be thermally treated or solvent extracted and metal-containing sediments need to be stabilized before land disposal at an off-site RCRA facility.

USEPA identified a disposal facility (EQ) in Wayne, Michigan that is TSCA and RCRA permitted and located approximately 550 miles from the site. Stabilization of metal-containing sediments prior to shipment to EQ in order to meet RCRA land disposal regulations is feasible and would cost $25 to 50 per cubic yard. Treatability tests would be needed to determine if it is feasible to treat organics prior to shipment. If thermal desorption could achieve the RCRA-required treatment levels, costs per yard for this treatment would range from $100 to $150. Since metals and organics are found throughout CS-B and Site M sediments, costs to meet RCRA UTS requirements would add a total of $1,250,000 to $2,000,000 to off-site disposal costs at the EQ facility.

Even if RCRA UTS requirements can be achieved with treatment, Solutia is unwilling to use a disposal facility that it has never used before because of the future liability associated with disposal. Solutia, by policy, transports hazardous wastes to Emelle, Alabama. Exceptions to this policy are made, however, only to facilities where Solutia has transported wastes in the past, e.g. Model City, NY. Solutia has shipped arsenic-containing material from its Trenton, Michigan to Wayne Disposal. It is Solutia's understanding that a new, separate cell is used for TSCA-regulated materials at the nearby EQ disposal facility.

Dioxin, if present in CS-B sediments, will also make off-site disposal difficult because RCRA and TSCA disposal facilities are typically not permitted to receive materials containing this constituent.

USEPA is currently in the process of shipping drums and impacted soils excavated from Sauget Area 2 Site Q to the SafetyKleen waste disposal facility in Lone Mountain, Oklahoma. SafetyKleen is quoting a disposal cost of $85 per ton which includes transportation. Using this disposal cost and material handling costs of $35 to $70 per ton to excavate, dewater, solidify and load CS-B and Site M sediments, total costs for excavation and off-site disposal at this facility would be $1,800,000 to $2,325,000. These cost estimates presume that the materials removed from Site Q and the sediments removed from CS-B and Site M have the same physical, chemical and regulatory characteristics. Solutia does not use the Lone Mountain facility for waste disposal.

In 1991/1992 Solutia evaluated off-site disposal by preparing its own estimate of removal and disposal costs and by soliciting bids from three contractors: 1) Chemical Waste Management, 2) Perland and 3) USPCI. Solutia's estimate and the contractors bids are summarized below:

Task	Solutia	Chem. Waste Management	Perland	USPCI
Design	568,590	15,000	30,000	14,900
Field Work	1,024,900	550,000	745,806	683,100
Transportation	1,846,000	495,000	1,124,900	0
Disposal	3,152,000	3,400,000	3,023,754	1,735,200
Infrastructure	960,000	960,000	960,000	960,000
PM, PR, Legal	730,000	730,000	730,000	730,000
Subtotal	8,281,490	6,150,000	6,613,750	4,123,000
Contingency(25%)	2,070,372	1,537,000	1,653,438	1,030,800
Total	10,351,862	7,687,500	8,267,188	6,184,000
Rounded	10,400,000	7,700,000	8,300,000	6,200,000
Facility	Emelle, AL	Emelle, Al	Emelle, Al	Grayback Mtn., UT
Distance	550 Miles	550 Miles	550 Miles	1,400 Miles
Shipping	Truck	Truck	Truck	Rail

No water treatment costs were included in the Solutia estimate or the contractor's bids.

Based on the contractor's bids, costs for off-site disposal of CS-B sediments range from $6,200,000 to $8,300,000. All of the contractors underestimate design costs with bids of

$15,000 to $30,000. USPCI, a subsidiary a major railroad at the time of the bid, deliberately underbid transportation and disposal costs in order to get business for what was then a new disposal facility. The major difference between the Chemical Waste Management and Perland bids is the cost of transportation with the former bidding $495,000 and the latter bidding $1,124,900, a difference of $754,000. This difference is probably due to the fact that Chemical Waste Management operated its own fleet of hazardous waste hauling trucks whereas Perland, a subsidiary of a construction contractor based in the northeast, needed to use contract haulers.

Based on the above analysis, costs for an off-site disposal removal action will be in the range of $1,8000,000 to $12,000,000 not including costs for agency oversight, water treatment, etc.

4.3 On-Site Containment

On-site containment of CS-B sediments would protect public health and the environment by isolating the impacted sediments in a secure disposal facility located on property owned by Solutia on the west bank of Dead Creek, south of Site G and north of Judith Lane. The containment cell would be located immediately adjacent to Dead Creek with a capacity of 10,000 to 15,000 cubic yards. It would occupy approximately an acre of land and be about 20 feet high.

Regulatory issues associated with on-site containment can be handled in a six month planning time frame. Since impacted sediments would be moved within the area of contamination, RCRA Universal Treatment Standards would not apply. A number of TSCA design issues need to be addressed, however, there should be no regulatory issues provided there are engineering solutions to the technical issues. TSCA technical requirements include the following:

- Underlying soil equivalent to three feet of compacted clay with a permeability of $1x10^{-7}$ cm/sec
- Synthetic membrane liners must be compatible with PCBs, have a minimum thickness of 30 mils and must have adequate soil underlying and cover

- Depth to groundwater must be greater than 50 feet
- Floodplains, shorelands and groundwater recharge areas should be avoided
- If the site is below the 100 year flood elevation, surface water diversion dikes will be installed with an elevation two feet higher than the 100 year flood elevation
- If the site is above the 100 year flood elevation, diversion structures capable of handling a 25 year, 24 hour storm will be installed. Slopes will be designed so that erosion will not occur as floodwaters recede
- Topography should have low to moderate relief
- A compound leachate collection system is required for:
  - a lined pit excavated into permeable soil
  - a cell constructed on sand and gravel
  - semi-liquid or leachable wastes

Topography at the proposed location of the on-site containment cell is essentially flat with a topographic variation of less than five feet. Depth to groundwater at the site ranges from 10 to 15 feet. To meet the 50 ft. depth to groundwater requirement, the on-site containment cell will be built above grade on top of a sand and/or gravel capillary barrier drain overlain by Bentomat®. Two 60 mil, geosynthetic membrane liners will be installed in the containment cell with a leachate collection system above the primary liner system and a leak detection system above the secondary liner system. HDPE, a material compatible with PCBs, will be used for the geosynthetic membranes. The cell will be built to RCRA minimum technology standards.

The proposed on-site containment cell is not located in a 100 year floodplain, however, it is located in the American Bottoms which is the floodplain of the Mississippi River. A floodwall and dike system contain the Mississippi River and it is unlikely that the site will be flooded unless the flood wall is breached. During the flood of July and August 1993, the largest flood in the history of the region, the proposed site of the containment cell was not flooded. Solutia's River's Edge Landfill, a closed disposal facility located outside the floodwall, was flooded during the 1993 but floodwaters did not overtop the cap nor was the cap damaged as the floodwaters receded. To ensure that flooding does not damage the proposed on-site containment cell, slopes will be flat to prevent erosion as floodwaters recede. A gravel armoring will be used on the lower portions of the side slopes, instead of a vegetated cover, to provide additional erosion protection during floods.

From a RCRA and TSCA perspective, on-site containment of CS-B sediments is a viable alternative. In addition, on-site containment of PCB-containing sediments is an established practice in Region 5 with cells approved and/or constructed for projects at Waukegan Harbor, Grand Calumet River and Willow Run. Public acceptance of an on-site containment cell does not appear to be an issue. Public meetings indicate that flooding is the primary concern. Lack of progress on a remedy is also a concern. Local, state and federal elected officials were briefed on the plans for on-site containment of CS-B sediments and have expressed no objections to construction of an on-site cell.

Estimated construction cost of a 10,000 cubic yard, on-site containment cell, including engineering and construction management, is $1,200,000 and a 15,000 cubic yard cell would cost $1,800,000. Excavation, dewatering and transfer of sediments is estimated to cost $500,000 to $1,500,000 ($50 to $100 per yard), resulting an estimated total project cost of $1,700,000 to $3,300,000. A cell of this size range can be constructed in two to four months depending upon weather conditions and availability of labor, equipment and materials.

5.0 Comparative Analysis

On-site containment is a protective and cost-effective remedy that can be implemented as a short-term removal action or as a long-term remedy. It provides the same level of protection of public health and the environment as off-site incineration and off-site disposal. Risks associated with shipping 750 truck loads of PCB-containing sediments distances of 500 to 1,500 miles are eliminated by containing Creek Segment B and Site M sediments on site. Costs for on-site containment are comparable to the low end cost for off-site disposal and are significantly lower than the cost of off-site incineration:

Remedial Alternative	Low End Cost	High End Cost
Off-Site Incineration	$10,500,000	$16,900,000

Remedial Alternative	Low End Cost	High End Cost
Off-Site Disposal	$1,800,000	$12,000,000
On-Site Containment	$1,700,000	$3,300,000

Low end off-site disposal costs can be achieved if: 1) treatment to meet RCRA UTS requirements for metals and organics is not necessary, 2) SafetyKleen stands by its $85 per ton transportation and disposal cost for its Lone Mountain, Oklahoma facility and 3) Solutia changes its policy on disposal of hazardous wastes at disposal facilities other than Emelle, Alabama. As discussed in Section 4.2 Off-Site Disposal, sediments from CS-B and Site M need to be treated to reduce organic concentrations to the RCRA Universal Treatment Standards and metals concentrations by 90% or to 10 times the Universal Treatment Standards (as measured by TCLP), whichever is lower. Treatment will increase the time and cost of off-site disposal making it a less feasible alternative compared to on-site containment. Estimated treatment costs are $100 to $150 per cubic yard for organics and $25 to $50 per cubic yard for metals. For 10,000 cubic yards, treatment to meet RCRA UTS requirements will cost $1,250,000 to $2,000,000. Total low end off-site disposal cost, including treatment and assuming disposal at Lone Mountain at prices SafetyKleen quoted to the Agency, will be $3,050,000 to 3,800,000.

The area adjacent to Creek Segment B has been historically used for waste disposal so construction of an on-site containment cell is consistent with historical land use. Local, state and federal elected officials do not object to construction of an on-site containment cell. Implementing an on-site containment removal action will demonstrate to the public that action is being taken after many years of study.

In summary, on-site containment is a protective, cost-effective removal action that will meet the public's desire for action. For these reasons, on-site containment is the preferred removal action for sediments in Creek Segment B and Site M.